ADDITIONS TO THE PLEISTOCENE
MAMMALIAN FAUNA FROM MELBOURNE, FLORIDA

By Clayton E. Ray

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INTRODUCTION

Of the 33 genera of native wild mammals (exclusive of bats, whales, and seals) now or recently living in Florida, 31 have been recorded from the Pleistocene. The two genera not yet reported are small forms (*Sorex* and *Glaucomys*) which might easily escape notice and which for obvious reasons must be rare fossils in any case. In addition to the 31 genera known both from the Pleistocene and from the Recent, 25 are known from the Pleistocene only, of which 14 have subsequently become totally and 11 locally extinct. The discovery of fossil human remains at Vero (Sellards, 1916) and at Melbourne (Loomis, 1924) has lent great impetus to the study of the Pleistocene in Florida, and is thus in part responsible for our relatively complete knowledge of the mammalian fauna. A large fraction of the literature on Floridian vertebrate paleontology is devoted to the interpretation of these controversial human remains, with which problem the present communication is not directly concerned.

Published information regarding the fossil mammals (exclusive of man) of Melbourne is in no way commensurate with the potentialities of the extensive museum collections from the locality, a situation due primarily to the untimely death of Dr. J. W. Gidley of the U. S. National Museum who supervised field work at Melbourne during the 1920's and who intended to report upon the mammals. Most of the 84 papers listed by Ray (1957) deal with human remains or with vertebrates other than mammals. Particularly neglected in the literature is a large series of fossils from Melbourne in the Museum of Comparative Zoology, known as the Singleton Collection. The only studies of the mammals in this collection are the description of *Molossides floridanus* by Allen (1932), the discussion of a jaw of *Dasypus bellus* by Simpson (1929B, p. 577), and the discussion of P^3 of *Tanupolama mirifica* by Bader (1957, p. 61). That the existence of the Singleton Collection is generally unknown is indicated by Rouse's ignorance of it in his very careful studies (1951, p. 154), and by the

recorded "disappearance" of certain specimens which are in fact
in the Singleton Collection (see under *Homo sapiens* and *Dasypus
bellus* below).

It seems useful to outline the history of the collection in order
to supplement the inadequate field data and thereby to establish
as clearly as possible the locality and horizon of the specimens.
The Singleton Collection was acquired in 1928 through the efforts
of Dr. Thomas Barbour, then Director of the Museum, who states
(1929, p. 6) as follows: "In cooperation with the United States
National Museum, Mr. C. P. Singleton continued to excavate in
the Pleistocene deposits near Melbourne, Florida, during the
months when he was not employed by Dr. Gidley. Dr. Gidley is
preparing a report on this material. The described specimens
then will be forwarded to Cambridge — that is those which were
obtained by Mr. Singleton during the half year in which he was
working for us." The projected report was never published, due
to Gidley's death in 1931 shortly after his last season at Mel-
bourne. As anticipated by Barbour, that portion of the collection
belonging to the Museum of Comparative Zoology was indeed
forwarded to Cambridge where it has remained unstudied and
in part uncatalogued to the present time. The chance discovery
of the jaw of a wolf-like canid among this material suggested
that other new information might be gleaned from this long-
dormant source, and the entire Singleton Collection was accord-
ingly examined. As might be expected, most of the species are
represented by comparable or better material in the U. S. National
Museum. A cursory examination of the Amherst College collec-
tion has revealed nothing to be added to the report by Loomis
(1924, p. 506). The Singleton Collection yields seven species new
to the Melbourne locality (*Blarina brevicauda*, *Peromyscus gos-
sypinus*, *Synaptomys australis*, *Mephitis mephitis*, *Felis* cf. *in-
expectata*, *Canis* cf. *lupus*, and *Monachus tropicalis*) of which
two (*Canis* cf. *lupus* and *Monachus tropicalis*) are new to the
recorded Pleistocene fauna of Florida, and one (*Monachus trop-
icalis*) is here recorded as a fossil for the first time.

STRATIGRAPHY

Some uncertainty exists regarding the provenance of individ-
ual specimens from the Singleton Collection. Pleistocene fossils

have been collected from two major localities in the vicinity of
Melbourne,[1] both discovered by Singleton. The first of these,
reported to the National Museum in 1922, is 1.5 miles southwest
of Melbourne and has been called the Singleton Estate locality.
Loomis excavated here during December, 1923, obtaining a small
but representative fauna (Loomis, 1924). Since little if any
work was carried on at this site during subsequent years, and
since Singleton divided his collections as of 1925 between Amherst
College and the U. S. National Museum (Gidley and Loomis,
1926, p. 255), it appears improbable that any material from
the Singleton Estate locality became incorporated into the Single-
ton Collection. Beginning in 1925, with a joint project between
Amherst and the National Museum, and continued in later years
(through 1930) by the National Museum alone, excavations were
concentrated at the "Golf Course" locality, Melbourne. Single-
ton was employed during the field seasons of all these years, and
it was at the Golf Course locality that he and Gidley collected
during the winter of 1928-29. Recalling Barbour's statement
that Singleton continued field work for the Museum of Com-
parative Zoology during the months immediately following, the
Golf Course locality seems to be the most probable source of the
Singleton Collection. The museum labels record the locality
simply as "Melbourne," with the exception of those accompany-
ing the specimens of *Peromyscus gossypinus* and *Canis* cf. *lupus*
which read "Melbourne, 2 miles west of." It was at first sus-
pected that these labels indicated some locality other than the
Golf Course and that the fossils might therefore not necessarily
be derived from beds of certain Pleistocene age (Stratum 2).
However, in response to the present author's query, Dr. C. L.
Gazin of the National Museum has very kindly supplied (*in litt.*,
October 29, 1956) the following information: "With regard to
the location 'Melbourne 2 mile W,' this must mean the golf course,
as I note on several labels here in Gidley's handwriting the
statement 'Golf links, 2 miles west of Melbourne.'" Thus it
seems safe to assume that the Singleton Collection derives from
the Golf Course locality.

[1] A comprehensive account of the history of discovery, the geography, and
development of the Melbourne finds is that of Gidley and Loomis (1926).

The Quaternary stratigraphy at the Golf Course locality is summarized in Table 1. At the time of discovery of human remains at Vero, Sellards (1916) considered both Stratum 2 and Stratum 3 to be Pleistocene in age. Owing to the widespread interest in human paleontology, the age of these beds and of the included fossils has been heatedly debated during the intervening 40 years, resulting in the accumulation of a voluminous polemic literature. Rouse (1951, pp. 30-34, 153-162, 234-237) may be consulted for a useful nonpartisan review of the evidence.

In brief, the evidence indicates that Stratum 2, containing abundant, primarily deposited extinct mammals, is late Pleistocene in age. Stratum 3 is Recent[2] in age, the supposedly extinct species in it having been synonymized with living species, or considered to be redeposited. The human remains were deposited in the upper layers of Stratum 2 or on the erosion surface above Stratum 2 (Rouse, 1951, p. 157).[3]

In regard to the source bed of the fossils of the Singleton Collection, it seems almost certain that all are derived from Stratum 2. Although this is not explicitly stated on the museum labels, all specimens are labeled ''Pleistocene.'' Such an assertion would scarcely have been made for fossils collected in Stratum 3 in view of its controversial age. In particular, Singleton who had long collecting experience both in Florida and in the western states, and who had worked with Gidley at Melbourne during the months immediately prior to collecting for the Museum of Comparative Zoology (as well as during preceding years), must have been aware of the extreme importance of segregating collections from the two strata. Furthermore, as indicated by Barbour, the Singleton collection and the National Museum collections were to be studied as a unit by Gidley, who certainly would not have mingled fossils from the two strata. Simpson (1929B, p. 579) implicitly considered the jaw of *Dasypus bellus* (described by him and discussed in the present report) to be derived from Stratum 2. The jaw of *Panthera augusta* from Melbourne described by Simpson (1941, p. 6) ''is not exactly

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[2] Following Morrison *et al.* (1957, p. 387) who quote with approval a statement by Lyell that "in the Recent we comprehend those deposits in which not only the shells but all the fossil Mammalia are of living species."

[3] On the basis of fluorine tests, Heizer and Cook (1952, p. 299) found samples of mammoth, horse, and human bone from Melbourne to be of a similar order of antiquity. The reliability of the fluorine evidence remains to be established.

TABLE 1

FORMATION	AGE	THICKNESS IN FEET	LITHOLOGY (from Cooke and Mossom, 1929, p. 219).
Van Valkenburg Beds (Sellards, 1940, p. 383), Stratum 3 (Sellards, 1916).	Recent	0-5 (Cooke and Mossom, 1929, p. 219); 1.5-2 (Gidley and Loomis, 1926, p. 258); 3-4 (avge.) (Gidley, 1929, p. 15).	"Swamp and stream deposits consisting of peat and partly decomposed roots, bark, and leaves, interstratified with yellowish or drab sand containing fresh-water mussel shells."
Melbourne Bone Bed (Cooke and Mossom, 1929, p. 218), Stratum 2 (Sellards, 1916).	Pleistocene	1-10 (Cooke and Mossom, 1929, p. 219).	"Fine white to light-brown sand containing a few local irregular lenses of marine shells and local accumulations of bones; where shell lenses are absent this bed appears massive or is streaked horizontally by dark carbonaceous sand."
Anastasia Formation (Sellards, 1912, pp. 7, 18), Stratum 1 (Sellards, 1916).	Pleistocene	Base not exposed.	"Coarse sandy coquina composed of rather firmly cemented broken shells and sand; base not exposed."

TABLE 1. Quaternary stratigraphy at the Golf Course locality, Melbourne, Florida.

labeled as to horizon but doubtless came from the 'No. 2 bed' or Melbourne formation." Gazin (1950, p. 397) found the National Museum collections to be inadequately labeled, but was convinced that their source was in or at the top of Stratum 2.

Thus, in spite of the lack of adequate data accompanying fossils of the Singleton Collection, the present author considers as established their derivation from Stratum 2 at the Golf Course locality, Melbourne.

FAUNA[4]

MARSUPIALIA

Didelphis marsupialis Linnaeus 1758, M.C.Z. 17767, 17768, 17770-17773.

An opossum indistinguishable from the modern North American species is represented by a considerable number of bones, including six more or less complete mandibular rami, three maxillae, 10 limb bones, some two dozen vertebrae, and about 20 fragments of skulls and jaws.

INSECTIVORA

Blarina brevicauda (Say) 1823, M.C.Z. 17793.

The short-tailed shrew, hitherto unknown from Melbourne and reported elsewhere in the Pleistocene of Florida only from Vero and Arredondo, is represented by two right mandibular rami, one of them essentially complete but having lost all teeth except I_3, the other lacking the anterior end but retaining well-preserved M_1-M_3. Both jaws are slightly smaller than available comparative specimens, but otherwise are quite characteristic of the species.

Scalopus aquaticus (Linnaeus) 1758, M.C.Z. 17792.

Three mandibular rami, four ulnae, and 14 of the highly characteristic humeri are included.

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[4]The author wishes to point out that most of the specimens in the Singleton Collection bore museum identifications which upon checking proved to be generally well founded. These identifications are probably to be credited to Drs. J. W. Gidley and G. M. Allen. Throughout the discussion, M.C.Z. stands for Museum of Comparative Zoology, C.N.H.M. for Chicago Natural History Museum, U.S.N.M. for United States National Museum, and A.M.N.H. for American Museum of Natural History.

CHIROPTERA

Molossides floridanus G. M. Allen 1932, M.C.Z. 17672.

This monotypic genus is known only from the type specimen, a left mandibular ramus with well-preserved M_1-M_3. Allen (1932) may be consulted for description and illustration of the jaw.[5]

PRIMATES

Homo sapiens Linnaeus 1758, M.C.Z. 5909, 5910, 17839, 17840. Harvard Peabody Museum A6289, A6296, A7442-A7452, A9611, A9612, 35619-35622.

The Singleton Collection contains no human bones, but several artifacts attest to the presence of man. The artifacts, excepting four mammal bones, have been transferred to the Peabody Museum. The mammal bones are three carved and polished mandibular rami of *Odocoileus virginianus* and a carved partial left maxilla and premaxilla with the canine tooth preserved of *Canis* sp. Most interesting of the artifacts is a crude stone blade found on exhibition in the Museum of Comparative Zoology. This specimen bears U. S. N. M. No. 342,218 and a gummed label reading as follows: "Found directly under and in contact with mastodon bone. *Harvard* C.P.S. 1928." Apparently Singleton's label was noticed after the specimen had been inadvertently catalogued in the National Museum whereupon it was sent on to Cambridge where it remained unnoticed, on exhibition, until rediscovered in 1957 and catalogued by the Harvard Peabody Museum (35619). This history explains Rouse's inability to find the specimen in the National Museum (1951, p. 158). The specimen is apparently that referred to by Gidley and Singleton (1929, p. xiv), as suspected by Rouse. It has been referred to also by Gidley (1931, p. 41) who considered it to represent "additional evidence of early man in Florida." Stephen Williams of the Peabody Museum contemplates a more detailed report on this and the other artifacts from Melbourne.

[5] This specimen is housed in the collection of types in the mammal department. All others, excepting most artifacts which are in the Peabody Museum, are in the vertebrate paleontological collection. All M.C.Z. numbers are those of the Department of Vertebrate Paleontology.

EDENTATA

Megalonyx cf. *wheatleyi* Cope 1871, M.C.Z. 17774, 17775.

Megalonyx is represented in the Singleton Collection by 10 tooth fragments, a right humerus and a right femur. The limb bones are without epiphyses and are spongy in texture, indicative of youth. These bones together with the teeth are here tentatively referred to *M. wheatleyi* following the examples of Simpson (1928, pp. 11-13) and of Gazin (1950, p. 398). This reference constitutes little more than a nomenclatural convenience pending a revision of the genus.

Paramylodon cf. *harlani* (Owen) 1840, M.C.Z. 2967.

A well preserved supraoccipital bone furnishes the basis for recording *Paramylodon* in the Singleton Collection. The bone, apparently that of a young individual, shows the characteristic development of sinuses between the dorsal internal and external tables of the skull. The inner table reveals a well-preserved cast of the cerebellar surface.

Dasypus bellus (Simpson) 1929, M.C.Z. 17802, 17803, fig. 3.

This species is represented by the distal half of a right humerus, a right radius, a right third metatarsal, a left calcaneum, a phalanx, three isolated teeth, several hundred dermal scutes, and a single fragment of a left lower jaw with four teeth in place and an alveolus for a fifth tooth anterior to these, and by a single isolated tooth accompanying the jaw. The jaw corresponds in every respect to that described by Simpson (1929b, p. 579) in his original description of the species:[6] "Through the courtesy of Dr. Gidley I have been able to examine a jaw of this species, collected by C. P. Singleton at Melbourne, and hence to identify other isolated teeth. The Melbourne specimen includes five teeth and an alveolus for another anterior to these. There was probably one and perhaps several more teeth in the complete jaw. The more anterior teeth are elongate, with flattened sides and rounded ends, wider posteriorly than anteriorly. The more posterior teeth are nearly circular, the largest slightly wider than long. They reach a maximum length of about 5 mm., depth about 13 mm."

[6] This fact was recognized by G. M. Allen, as indicated by a note in his handwriting accompanying the specimen.

The fifth and hindmost tooth has obviously become detached since Simpson's description, but remains with the jaw, and has been replaced for purposes of illustration. As stated by Simpson, Gidley was quite naturally in possession of the specimen in 1929, but that it belongs to the Singleton Collection and is, in fact, the jaw discussed here, is verified by Gazin's (1950, p. 399) failure to find it in the National Museum collections. The species has been reported from eight additional localities in Florida and from a cave in St. Louis, Missouri (Simpson, 1949, p. 11), but so far as the literature reveals, the present specimen is the only dentigerous element known.

Chlamytherium septentrionalis (Leidy) 1890, M.C.Z. 17794, 17795.

Material referable to this extinct giant armadillo-like edentate includes more than 100 dermal scutes (17795) and six teeth (17794). James (1957) is followed in synonymizing *Holmesina* Simpson 1930 with *Chlamytherium* Lund 1838.

LAGOMORPHA

Sylvilagus palustris (Bachman) 1837, M.C.Z. 17776, 17777.

Some 24 fragmentary mandibular rami, three fragmentary upper jaws, and miscellaneous limb bones are referred to the marsh rabbit. All material was examined with especial attention to the possibility of the pygmy species, *Sylvilagus palustrellus*, being represented in the collection. This species was described by Gazin (1950, p. 399) on the basis of a left mandibular ramus from Melbourne (type) and a second, possibly sub-Recent, specimen from Sugarloaf Key.[7] Species characteristics are given as follows: size $\frac{2}{3}$ that of *S. palustris*, jaw shallow, teeth relatively narrow transversely, and anterior wall of P_3 with a single shallow fold. None of the specimens at hand seems to fulfill these requirements. Of the 13 rami with P_3 in place, all show at least two crenulations on the anterior wall of P_3. Two of these rami are small in size but retain the P_3 typical of *S. palustris* and can be matched almost perfectly in size, propor-

[7] In this connection, it may be noted that one Colonel Patterson of Key West, Florida, informed De Pourtales (1877, p. 142) of the possibility that the "aquatic rabbit" ranged as far as Key West and that "a burrowing rabbit" is found on Rabbit Key (N.25°, W.80°50'). Neither Nelson (1909), Hall (1951), nor Schwartz (1956) record rabbits from the Keys.

tions, and texture ("sponginess") by immature Recent *S. palustris* (as M.C.Z. 3420).

Sylvilagus palustrellus should be compared to *Sylvilagus leonensis* (also a pygmy) described by Cushing (1945, p. 183) from San Josecito Cave, Nuevo Leon, Mexico. Unfortunately neither description is accompanied by illustrations. *Sylvilagus palustrellus* may be related to the lagomorph from Vero which Sellards (1916, p. 15) compared to *Romerolagus* and *Pronolagus* but considered to represent a new genus (which he never described). It seems that the Pleistocene lagomorphs of Florida might profitably be re-examined.

RODENTIA

Geomys pinctis Rafinesque 1817, M.C.Z. 17779, 17780.

The pocket gopher is represented by some 70 mandibular rami (mostly fragmentary), a palate with P^4 and M^1 on both sides, a rostrum with one incisor, nine isolated upper incisors, and miscellaneous limb bones. The fossils are indistinguishable from the species presently living in the area. No remains of *Plesiothomomys* were discovered in the collection.

Oryzomys palustris (Harlan) 1837, M.C.Z. 17786, Fig. 1B.

The rice rat is represented by eight mandibular rami, only one of which is considered to be strictly identifiable to species. With the exception of this single relatively complete specimen in which M_1 and M_2 are preserved, the jaws are without cheek teeth. Previous records of the rice rat from Melbourne are generic only. In addition to *Oryzomys palustris* the fossil specimens were compared with *O. couesi, O. rostratus, O. alfaroi, O. talamancae*, and *O. devius*, and were found to be readily distinguishable from all of them except *O. palustris*. Of the forms examined, *O. couesi* seems to approach *O. palustris* most closely.

The differing configuration of the insertion scars of *M. masseter medialis, pars anterior* and of *M. masseter lateralis profundus, pars anterior* (see Rinker, 1954, p. 16, fig. 1B) on the lateral surface of the mandibular ramus seems to be a character useful in distinguishing certain closely related species of cricetine rodents. If substantiated by examination of more specimens than have been available to the author, such a character would be of value in the identification of toothless jaws. *Oryzomys*

palustris is distinguished from *O. couesi* on the basis of the sharp dorsad flexure of the anterior portions of the two masseteric scars in the latter species. As seen in labial view with the tooth-line taken as the horizontal (Fig. 1B), the more dorsal of the
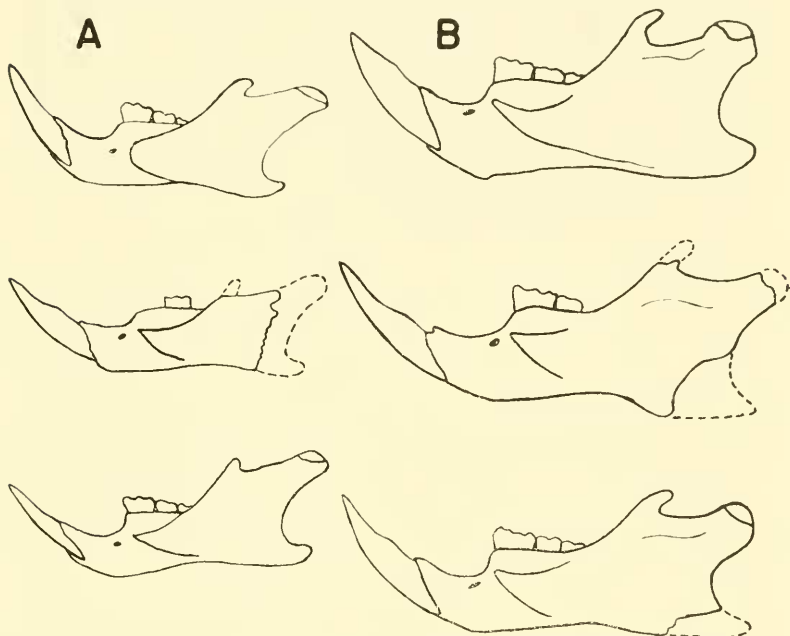

Figure 1A. Labial view of left mandibular rami of *Peromyscus nuttalli* (M.C.Z. 1491, top), *P. gossypinus*, fossil (M.C.Z. 17778, center), and *P. gossypinus* (M.C.Z. 3226, bottom). X2.75.

1B. Labial view of left mandibular rami of *Oryzomys couesi* (M.C.Z. 1532, top), *O. palustris*, fossil (M.C.Z. 17786, center), and *O. palustris* (M.C.Z. 4465, bottom). X2.75.

two scars (*M. masseter medialis*) in *O. couesi* is deeply concave upward having its most ventrad extension under the point between M_1 and M_2. In contrast, the most ventrad point on the scar in *O. palustris* lies at or near the apex of the V formed by

the anterior intersection of the two masseteric scars. The jaws from Melbourne resemble *O. palustris* in configuration of the masseteric scars.

Peromyscus gossypinus (Le Conte) 1853, M.C.Z. 17778, Fig. 1A.

The cotton mouse is represented by two left mandibular rami, both of which retain incisors but lack cheek teeth with the exception of a very worn M_2 in one of the specimens. Records of the genus in the Pleistocene of Florida are highly unsatisfactory and certainly not indicative of true rarity. Gut (1939, p. 55) reports *Peromyscus* sp. from Reddick, Marion County; Bader (1957, p. 54), *Peromyscus* sp. from Arredondo; Sherman (1952, p. 92-93), *P. gossypinus* and *P. floridanus* without locality data.[8]

The specimens were compared with series of *P. floridanus*, *P. polionotus*, *P. nuttalli*, and *P. gossypinus*. Gross size readily distinguishes the fossils from *P. floridanus* and *P. polionotus*, the former being larger and the latter smaller than the fossils. Recent specimens of both *P. nuttalli* and *P. gossypinus* correspond in size to the fossils. As in the case of *Oryzomys* (above), the two species in question can be distinguished on the basis of the configuration of the scars of *M. masseter medialis, pars anterior*, and *M. masseter lateralis profundus, pars anterior*. In *P. gossypinus* the anterior portions of the scars intersect in a narrow, sharply-pointed V, the apex of which is directed dorsad with the *M. masseter medialis* scar consequently concave upward as seen in lateral view (Fig. 1A). The same scars in *P. nuttalli* intersect anteriorly in a broadly rounded U, the apex of which is directed ventrad with the *M. masseter medialis* scar more nearly straight and more steeply inclined relative to the tooth row than in *P. gossypinus*. In series of approximately 30 jaws of each species, the configurations described were found to be somewhat variable, but in all cases distinguished the species. The fossil jaws are typical of *P. gossypinus* in regard to the masseteric scars.

Sigmodon hispidus Say and Ord 1825, M.C.Z. 17798.

Some 64 lower jaws, many with complete dentition, three maxillary fragments, and about 25 limb bones of the cotton rat are present in the collection.

[8] Sherman *(in litt.*, November 18, 1956) states that these records are from the Reddick locality and that they are based on personal communications from Mr. Gut. At Dr. Sherman's request, this opportunity is taken to credit the first report of the species *Peromyscus gossypinus* and *P. floridanus* in the Pleistocene of Florida to Mr. Gut.

Neotoma floridana (Ord) 1818, M.C.Z. 17799.

The wood rat is represented by 30 mandibular rami and a fragmentary maxilla with M^1.

Synaptomys australis Simpson 1928, M.C.Z. 17785.

The southern bog lemming, hitherto known only from the type locality of Saber-tooth Cave and from Arredondo, can now be recorded from Melbourne on the basis of four fragmentary rami of lower jaws, all of which are somewhat smaller than the type specimen (Simpson, 1928, p. 7). The triturating surface of the molars in the only specimen with complete dentition is 8.0 mm. in length as compared to 8.4 mm. in the type. One of the rami (without molars) is quite comparable to the living *S. cooperi* in size, but apparently is a young *S. australis,* being distinguished from *S. cooperi* by the more open arc described by its incisor. Indistinct, rounded muscle scars and crests are suggestive of youth in the specimen.

Neofiber alleni True 1884, M.C.Z. 17796, 17797.

The round-tailed muskrat is represented by the following specimens: 34 mandibular rami, three palatal fragments, numerous isolated molariform teeth, and 16 postcranial elements. The absence of *Ondatra* from the collection adds further weight to the contention of Neill (1957, pp. 7, 8) that the two genera were allopatric during the Pleistocene just as they are at present.

CARNIVORA

Aenocyon sp., cf. *A. ayersi* (Sellards) 1916, M.C.Z. 5912.

Remains of *Aenocyon* consist of the distal one third of a left humerus, a left radius lacking the proximal extremity, a cervical vertebra, and a distal fragment of a metapodial.

Canis sp., cf. *C. latrans* Say 1823, M.C.Z. 5909, 17790.

A coyote-sized canid is represented by two calcanea, an astragalus, and a rostral fragment consisting of the left premaxilla and the adjacent portion of the left maxilla with C^1. The bones are indistinguishable from the living *Canis latrans.* The species *C. riviveronis* Hay 1917, described from Stratum 3 at Vero, is inadequately separated from *C. latrans.* In his original diagnosis Hay (1917, pp. 59, 60) noted overlap with *latrans* in each of the supposedly distinguishing characters. There is in Hay's description no basis upon which *riviveronis* can be distinguished from *latrans* and it is here placed in the synonymy of the living species.

The tooth-bearing fragment (M.C.Z. 5909) is an artifact. Its dorsal border is a straight, polished edge paralleling the palatal surface at the level of the root-tip of the canine. Its posterior border is a straight edge perpendicular to the dorsal border and bisecting the posterior root of P^2.

Canis sp., cf. *C. lupus* Linnaeus 1758, M.C.Z. 17789, Fig. 2.

Although *Aenocyon* is known from at least eight localities including Melbourne, the present record is the first for a wolf of modern type from the Pleistocene of Florida. Simpson
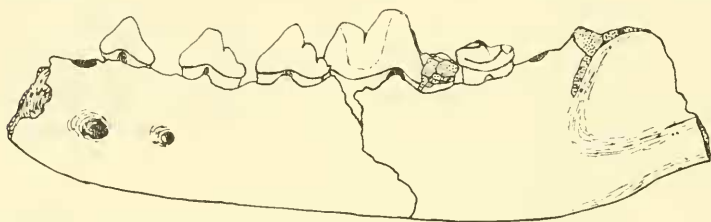

Figure 2. Labial view of left mandibular ramus of *Canis* sp., cf. *C. lupus*, M.C.Z. 17789. X 2/3.

(1929b, pp. 572-573) notes a larger and a smaller size class within the large canid material from Saber-tooth Cave and Seminole Field but tentatively refers both groups to *Aenocyon ayersi*. The smaller form falls within the size range of modern *C. lupus*, however, and may very well pertain to that species.

The present record is based upon a well-preserved left mandibular ramus[9] lacking angular and coronoid processes and the anterior extremity beyond the canine alveolus but with $P_2 - M_2$ present and undamaged (excepting the postero-lateral corner of M_1). In spite of the relative completeness of the jaw, it was not possible to definitely establish its specific identity.[10] According to the most recent comprehensive review (Goldman, 1944) there are two living species of North American wolves, *C. lupus* and *C. niger*, the latter being distinguished by its

[9] The specimen is accompanied by a field label indicating that it was collected from a depth of four feet which would seemingly place it within Stratum 2. The label is dated June 23 (presumably 1929) and initialed by C. P. Singleton.

[10] The field label bears the note initialed by Gidley, "compare *Canis lycaon*," now *Canis lupus lycaon*.

smaller size, more slender skull, more deeply cleft molariform teeth, more laterally compressed cusps of molariform teeth, and more trenchant points and shearing edges of molariform teeth (Goldman, pp. 478-481). Both species have been at least tentatively identified from Florida, *C. niger niger*[11] having been originally described from Florida and *C. lupus* recorded on the basis of a skull (M.C.Z. 11179) from somewhere in Florida (Goldman, p. 440). Examination and measurement of the eight jaws of *niger* in the Museum of Comparative Zoology and the American Museum of Natural History and of a great many jaws of *lupus* led to the conclusion that the species are sufficiently similar in size as to be indistinguishable (on the basis of lower jaws) unless sex and age are known and taken into consideration, and perhaps not then (Table 2). The characters of the cheek teeth were considered to be inadequate for a reliable conclusion to be made

Vulpes sp., cf. *V. palmaria* Hay 1917, M.C.Z. 5857.

The genus *Vulpes* is represented by the distal half of a right humerus and by a left second metatarsal. These bones compare closely with those of modern *V. fulva*. At the time of Hay's description (1917, p. 57) of *Vulpes palmaria* from Stratum 3 at Vero, the living North American red foxes were distributed taxonomically among at least ten "species," whereas they are now assigned to one, with former species names reduced to subspecies. Hay compared and contrasted the fossil primarily with *V. fulva fulva*, one of the smaller subspecies as now understood. Examination of the very large series of *V. fulva* in the Museum of Comparative Zoology revealed none with a lower jaw quite so deep as that of the type specimen of *V. palmaria*. Only the largest modern jaw (M.C.Z. 34097) approaches the fossil closely in this regard (Table 3). In view of this slight size discrepancy and of the remote possibility that some or all of modern North American red foxes are descendants of introduced European stock (Palmer, 1956, pp. 67, 68), it seems best to retain the name *palmaria* until better Pleistocene material is found. Further discoveries may indicate that *palmaria* is a robust Pleistocene subspecies of *V. fulva*.

[11] Unfortunately only two skulls of the type subspecies found their way into museum collections before the animal became extinct. A third skull (M.C.Z. 11179) tentatively assigned to *C. lupus lycaon* may pertain to *C. niger*.

	Canis (?)lupus, M.C.Z. 17789, Melbourne, Florida, Pleistocene.	Canis (?)lupus, M.C.Z. 11179, Florida.	Canis niger gregoryi, M.C.Z. 21531, Poplar Bluff, Missouri, male.	Canis lupus nubilus, M.C.Z. 65, northwestern Kansas.	Canis lupus lycaon, M.C.Z. 40936, Wisconsin.	Canis lupus pallipes, C.N.H.M. 44468, Seri Hassan Beg, Mtns., Iraq.
Length of P_2	11.3	11.9	11.5*	6.9	12.5	12.2
Width of P_2	5.3	5.8	5.4	2.8	6.4	6.0
Length of P_3	13.3	13.5	13.0*	12.6	14.0	13.0
Width of P_3	6.0	6.6	5.6	6.1	7.0	6.2
Length of P_4	15.1	16.0	14.6	14.6	15.9	15.1
Width of P_4	7.6	7.3	6.9	7.4	8.3	7.4
Length of M_1	26.3	27.5	25.8	26.8	28.8	26.8
Width of M_1	10.3	10.7	11.0	11.7	11.9	10.8
Length of M_2	11.8		11.1	10.7	11.0	11.1
Width of M_2	8.2		8.1	8.6	8.9	7.7
Length of P_1 through M_3	94.1	92.2	90.0	94.1	93.6	91.5
Length of P_2 through P_3	28.8	27.2	25.8	26.5	28.2	27.8
Length of P_2 through P_4	45.1	44.1	41.7	43.4	45.3	43.4
Length of P_2 through M_1	70.3	70.0	67.4	69.9	73.3	69.3
Length of P_2 through M_2	81.7	81.6	78.4	80.3	83.6	79.3
Depth of ramus between P_4 and M_1	27.0	28.6	27.5	28.1	27.7	26.5
Width of ramus between P_4 and M_1	11.5	13.1	12.1	11.7	13.6	11.7

TABLE 2. Measurements (mm.) of left mandibular rami of selected individuals of *Canis lupus* and *Canis niger*. Asterisks indicate inaccurate measurements.

	Vulpes palmaria type, U.S.N.M. 8834	Vulpes fulva macroura M.C.Z. 34097	Vulpes fulva abietorum M.C.Z. 34526, male	Vulpes fulva abietorum M.C.Z. 34525, female	Vulpes fulva U.S.N.M. 810	Vulpes macroura U.S.N.M. 67384
Height of jaw at rear of PM_4	18.0	17.3	16.0	15.9	13.5	14.0
Thickness of jaw at rear of PM_4	7.2	7.8	7.4	7.3	6.0	7.0
Height of jaw at front of PM_3	14.0	13.3	14.3	13.9	11.4	13.0
Thickness of jaw at front of PM_3	7.0	6.1	6.7	7.2	6.0	6.0
Length of PM_3	9.1	8.5	10.6	10.1	9.0	10.0
Width of PM_3	3.5	3.7	4.0	3.8	3.2	3.4
Length of PM_4	10.4	10.0	11.3	11.2	9.6	10.0
Width of PM_4	4.3	4.7	5.2	5.0	4.1	4.0
Side-to-side diameter of socket of canine	6.5	6.1	6.6	5.7	5.1	

TABLE 3. Measurements (mm.) of right mandibular ramus of *Vulpes palmaria* and of selected rami of *Vulpes fulva*. Data in the first and in the last two columns from Hay (1917, p. 58).

URSIDAE, Gen. et sp. indet., M.C.Z. 17804, 17805.

Ursid material consists of a left M², left and right calcanea, right radius lacking distal extremity, left metacarpal I, right metatarsal IV, and a dozen phalanges. As many as three species of bears may have lived in Florida during the Pleistocene: the short-faced bear, *Tremarctos(?) floridanus* (Gidley) 1928, the black bear, *Ursus americanus* Pallas 1780, and a "true"[12] *Ursus*. The great homogeneity of the Ursidae as a family together with inadequacy of comparative material (one immature *Tremarctos ornatus*, one immature *Ursus horribilus*, and several *Ursus americanus*) rendered definite identification of the fossils impossible.

[12] Judging from context (Gazin, 1950, p. 401), "true" *Ursus* is intended to apply to *Ursus* minus the black bear (*Euarctos* of authors).

The molar is probably referable to *Ursus* on the basis of its strongly developed internal cingulum, and probably to *U. americanus* on the basis of size. The left metacarpal I is closely comparable to that of a very large *U. americanus*. The radius is slightly larger than that of a large *U. americanus* (M.C.Z. 9331). Comparative measurements (mm.) for the two (fossil first followed by M.C.Z. 9331) are as follows: greatest diameter of proximal articular facet, 41.7 and 38.5; width of shaft at midpoint, 24.0 and 22.7; thickness of shaft at midpoint, 16.8 and 16.1. The calcanea are considerably larger than those of a large *U. americanus*, as indicated by the following measurements:

	Fossil (left) calcaneum	M.C.Z. 9331
Length (parallel to shaft of posterior process)	85.2mm.	71.2
Maximum width (parallel to cuboid facet)	59.7	45.3
Width of cuboid facet	26.2	23.3

The obliquity of the cuboid facet relative to the shaft of the posterior process is suggestive of an aretothere as opposed to *Ursus*.

Procyon lotor (Linnaeus) 1758, M.C.Z. 17818, 17819.

A raccoon indistinguishable from the living North American species is represented by 17 fragmentary mandibular rami, a fragment of a left maxilla with P^2, several isolated upper molars, and a number of limb bones. None of the specimens is suggestive of *Procyon nanus* Simpson 1929.

Mephitis mephitis (Schreber) 1776, M.C.Z. 17788.

The striped skunk has hitherto been reported in the Pleistocene of Florida only from Saber-tooth Cave, Citrus County, and Seminole Field, Pinellas County. It is now possible to record the species from Melbourne on the basis of a well-preserved left mandibular ramus essentially complete but lacking teeth with the exception of a very worn M_1.

Spilogale ambarvalis Bangs 1898, M.C.Z. 17787.

The little spotted skunk is recorded on the basis of two left mandibular rami, both quite complete posteriorly but lacking anterior extremities. The dentition is represented in both cases by P_4 and M_1, slightly worn in one and heavily worn in the other.

Lutra canadensis (Schreber) 1776, M.C.Z. 17783, 17784.

Material referable to the modern river otter includes two left maxillary fragments each with P^4, fragments of a cranium, three fragmentary mandibular rami, three humeri, two femora, a tibia, an ulna, a radius, and four metatarsals.

Felis (Lynx) rufus (Schreber) 1777, M.C.Z. 17766, 17781, 17782.

The bobcat is represented by a fragmentary right mandibular ramus with $P_3 - M_1$, a fragmentary left ramus with P_3 only, isolated left M_1 and P^4, two calcanea, a humerus, an ulna, two radii, a femur, and two tibiae. Although none of this material is suggestive of a small cat other than a bobcat, Gazin's (1950, p. 402) record of a jaguarundi or margay type of cat at Melbourne is highly provocative. A re-examination of the fossils from other Florida localities that have been previously assigned to *Felis (Lynx) rufus* may reveal additional evidence relevant to this zoogeographically interesting possibility.

Felis sp., cf. *F. (Puma) inexpectata* (Cope) 1895, M.C.Z. 17791.

In the Singleton Collection are six phalanges, a right astragalus, a left radius, and two distal fragments of metapodials, none of which can be distinguished from comparable elements of Recent *Felis concolor*. These bones may tentatively be referred to *Felis inexpectata*, regarded by Simpson (1941, p. 23) as inadequately distinguished from *F. concolor*.

Monachus tropicalis (Gray) 1850, M.C.Z. 4439, Figs. 4, 5.

In the Singleton Collection are two bones labeled "sea lion or fur seal." One of these proved to be the left first metatarsal of an alligator (renumbered M.C.Z. 2811). The second bone does indeed belong to a pinniped, but not to an otariid as the original label states. The bone in question is the proximal phalanx of the right hallux of *Monachus tropicalis*. This identification is based on comparison of the fossil with skeletons of the following living species: *Monachus tropicalis*, *Phoca groenlandica*, *P. vitulina*, *Erignathus barbatus*, *Halichocrus grypus*, *Cystophora cristata*, *Mirounga angustirostris*, *Callorhinus ursinus*, *Eumetopias jubata*, *Zalophus californianus*, and *Odobenus rosmarus*. The proximal phalanx of the hallux in *Monachus tropicalis* was found to be very distinctive.

The shape and cross-section of the shaft is sufficient to separate the fossil from otariids and odobenids. In the fossil (and in all

phocids examined) the shaft has a ventro-medial sharp edge
producing an asymmetrical cross-section, whereas in otariids the
shaft is much flattened dorso-ventrally with a nearly symmetrical
cross-section and in *Odobenus* the shaft is thickened dorso-ven-
trally with an elliptical cross-section. The extremities of the bone
in *Odobenus* are enlarged and knoblike in comparison with other
pinnipeds.

In all phocids examined excepting *Monachus* and the fossil
there is a well-developed longitudinal channel extending the
length of the ventral surface of the shaft. This channel is well
developed only at the proximal end in *Monachus* and in the fossil,
the remainder of the shaft having a flat to gently convex ventral
surface (Fig. 5, right).

In all phocids excepting *Monachus* and the fossil the shaft of
the bone appears to be twisted, a feature readily apparent upon
comparison of the relative orientation of proximal and distal
articular facets. In *Monachus* and the fossil the distal articular
facet extends only slightly onto the dorsal and ventral surfaces
whereas in other phocids it extends considerably onto these sur-
faces (Figs. 4 and 5). The proximal articular surface in phocids
is subcircular in outline with a deep ventral indentation resulting
in a shape resembling a robust letter U (Fig. 4). *Monachus* and
the fossil differ from other phocids examined in having the
lateral arm of the U much larger than the medial and the medial
arm deflected distad relative to the plane of the articular facet
as a whole.

The fossil is matched almost perfectly by the corresponding
bone of an apparently old individual of *Monachus tropicalis*
(A.M.N.H. 10421, Figs. 4C, 5C). In both bones the epiphyses are
completely closed. These are among the last to fuse in the skel-
eton as closure occurs successively from proximal to distal el-
ements in the limbs (King, 1956, p. 250). Comparative measure-
ments (mm.) of the two (fossil first, followed by A.M.N.H.
10421) are as follows: length, 91.9 and 92.3; maximum breadth
of shaft measured parallel to ventral surface, 23.0 and 24.1;
minimum breadth of shaft, 14.3 and 14.4; maximum thickness of
shaft, 17.6 and 17.4; minimum, 8.8 and 8.5. The two specimens
are similar also in the presence of a very strong rugosity on the

anteromedial surface of the proximal end of the shaft (Figs. 4, 5).

The present record is well outside the known historic range of *Monachus tropicalis*. The monk seal has been recorded from southernmost Florida and was abundant in the Bahamas as late as 1707 (G. M. Allen, 1942, pp. 453, 454). The northernmost point in the Bahamas is Matanilla Reef at 27°25′N. as compared to Melbourne at 28°5′N. The monk seal was so quickly decimated at the hands of modern man that its pre-Columbian range cannot be determined, but it may well have included the Melbourne area.

Of considerable interest in connection with past distribution are the left and right auditory regions (presumably from the same individual) of *M. tropicalis* preserved in the mammal department of the museum (M.C.Z. 8741). Both specimens include the glenoid fossa, auditory bulla, mastoid, and petrosal. Unfortunately, locality and horizon are unknown, the only data accompanying the specimens being ''South Carolina?'' and ''R. W. Gibbes collection?'' Gibbes (1809-1866) was a life-long resident of Columbia, South Carolina, and his large collections derive almost entirely from the southeastern United States. If the specimens are from his collection as seems probable, they furnish a record (Pleistocene?) for the monk seal considerably north of its known historical range.

PROBOSCIDEA

Mammut americanum (Kerr) 1792, M.C.Z. 5837, 17806-17809, 17811-17815, 17829-17832, 17834-17837.

The American mastodon is represented by some 24 molars and by an immature right mandibular ramus. Most interesting of the teeth are two first lower deciduous molars, one deeply worn (17814) and one unworn (17815).

Mammuthus sp. indet., M.C.Z. 2013, 5838, 17820, 17821, 17823-17828.

Twelve isolated molars, mostly fragmentary, and a right mandibular ramus with M_3 are referred to the mammoth. The isolated molars are inseparable from the common *Mammuthus columbi*, and may be referred to that species. The M_3 in the mandible has not less than 19 enamel plates and technically should probably

be referred to *M. imperator*. Unidentified and uncatalogued proboscidean material includes a rib and tusk fragments.

PERISSODACTYLA

Equus sp. indet., M.C.Z. 2034-2038, 2041, 2042, 2051-2056, 2058-2065, 3348, 5911.

The genus *Equus* is represented by 233 isolated cheek teeth, 43 incisors (M.C.Z. 2051), a left mandibular ramus with $P_2 - M_2$ (M.C.Z. 2052), a fragment of a right ramus with P_2 (M.C.Z. 2052), a complete mandible with all molariform teeth, right I_2, and left C_1 (M.C.Z. 3348), a left ulna, and miscellaneous foot material. Savage (1951) is followed in withholding specific identification pending a revision of named species.

Tapirus sp., cf. *T. veroensis* Sellards 1918, M.C.Z. 5839, 7154-7158.

The Singleton Collection contains a considerable amount of tapir material including approximately 64 isolated but complete cheek teeth and eight fragmentary tooth-bearing elements each with one or more teeth in place but only one (M.C.Z. 5839) with a complete cheek tooth row. Noteworthy among these is a mandible of a very young individual with DP_2, DP_3, and the roots of DP_4 on the left side, and with $DP_2 - DP_4$ on the right. The symphysis remains intact, but anterior teeth have been lost, whereas the more posterior teeth remain unerupted.

ARTIODACTYLA

Mylohyus sp. indet., M.C.Z. 17871-17873.

Fourteen molariform teeth and two lower canines are referred to *Mylohyus*. No attempt has been made to identify these teeth specifically.

Platygonus sp. indet., M.C.Z. 17874.

The genus *Platygonus* is represented by five characteristic cheek teeth. Also representing the Tayassuidae but not further identified are two calcanea, a radio-ulna, a phalanx, and three astragali.

Tanupolama sp., cf. *T. mirifica* Simpson 1929, M.C.Z. 17816, 17817.

A camel comparable in size to *T. mirifica* is represented by three astragali, seven cheek teeth, and one incisor. Among the molariform teeth is the left P^3 illustrated by Bader (1957, p. 60, fig. 3).

Odocoileus virginianus (Boddaert) 1784, M.C.Z. 5910, 17838-17864.

Abundant remains of the white-tailed deer include eight fragmentary mandibular rami, 175 isolated teeth, and almost every part of the skeleton. Three of the mandibular rami (M.C.Z. 5910, 17839, 17840) have been worked in identical fashion by man. Beginning under P_2 and continuing posteriorly, the ventral border of each jaw has been beveled off smoothly parallel to the dorsal border of the ramus. No specimens suggestive of *O. sellardsiae* Hay 1917 were found in the collection. J. T. Gregory (in Rouse, 1951, p. 164) has described Hay's type description as "unconvincing," an opinion in which the present author heartily concurs.

Bison sp. indet., M.C.Z. 2015, 2016, 2026, 2029, 2032, 2033, 17875.

The following material is referred to the genus *Bison*: 12 vertebrae, one scapula, two humeri, two radii, one ulna, two tibiae, two metapodials, two astragali, 59 isolated cheek teeth, and one left mandibular ramus with $P_4 - M_3$. The mandibular ramus is very similar to the one from Bradenton figured by Simpson (1930, p. 12, fig. 7) and identified by him as *B. latifrons*. Comparative measurements (mm.) are as follows:

	A.M.N.H. 26831 (from photograph)	M.C.Z. 17875
Length $M_1 - M_3$	113.2	111.3
Length $P_2 - M_3$ (alveoli)	180.0	179.2

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APPENDIX: SPECIES LIST OF THE MELBOURNE MAMMALIAN FAUNA

The following list of species recorded from the Pleistocene of Melbourne is based on the papers of Simpson (1929A, p. 268) and Gazin (1950, pp. 397-404), and on the present study. Forms represented in the Singleton Collection are designated by an asterisk (*). Several exotic records listed in preliminary faunal lists for Melbourne but not followed up in later publications are excluded here. These include *Microtus*, antelope?, and reindeer? (Gidley, *in* Cooke, 1926, p. 445) and *Taurotragus?* (Gidley, *in* Hay, 1927, p. 274).

Didelphis marsupialis Linnaeus 1758 — opossum
Scalopus aquaticus (Linnaeus) 1758 — eastern mole
Blarina brevicauda (Say) 1823 — short-tailed shrew
Molossides floridanus G. M. Allen 1932 — molossid bat
Homo sapiens Linnaeus 1758 — man (artifacts only in Singleton Collection)
 Megalonyx jeffersonii (Desmarest) 1822 — ground sloth
Megalonyx cf. *wheatleyi* Cope 1871 — ground sloth
Paramylodon cf. *harlani* (Owen) 1840 — ground sloth
Dasypus bellus (Simpson) 1929 — armadillo
Chlamytherium septentrionalis (Leidy) 1890 — giant armadillo
 Boreostracon floridanus Simpson 1929 — glyptodont
 Sylvilagus floridanus (J. A. Allen) 1890 — cottontail rabbit
Sylvilagus palustris (Bachman) 1837 — marsh rabbit
 Sylvilagus palustrellus Gazin 1950 — pygmy marsh rabbit
Geomys pinetis Rafinesque 1817 — "salamander," gopher
 Castoroides cf. *ohioensis* Foster 1838 — giant beaver
Oryzomys palustris (Harlan) 1837 — rice rat
Peromyscus gossypinus (Le Conte) 1853 — cotton mouse
Sigmodon hispidus Say and Ord 1825 — cotton rat
Neotoma floridana (Ord) 1818 — wood rat
Synaptomys australis Simpson 1928 — southern bog lemming
Neofiber alleni True 1884 — round-tailed muskrat
 Neochoerus pinckneyi (Hay) 1923 — giant capybara
 Hydrochoerus sp. — capybara

Gazin (1950) does not list this genus, and it is barely possible that the material furnishing the basis for the record would now be referred to *Neochoerus*. However, Simpson (1929A, p. 268) lists *Hydrochoerus* and he would almost certainly have altered the name to *Neochoerus* (erected in 1926 by Hay) had the material been referable to the giant capybara.

*Canis cf. latrans Say 1823 — coyote
*Canis cf. lupus Linnaeus 1758 — wolf
*Aenocyon cf. ayersi (Sellards) 1916 — giant wolf
 Urocyon cf. cinercoargenteus (Schreber) 1775 — gray fox
*Vulpes ?palmaria Hay 1917 — "red" fox
*Tremarctos(?) floridanus (Gidley) 1928 — short-faced bear
 Ursus americanus Pallas 1780 — black bear
 Ursus sp. — large "true" Ursus (see Gazin, 1950, p. 401)
*Procyon lotor (Linnaeus) 1758 — raccoon
*Spilogale ambarvalis Bangs 1898 — little spotted skunk
*Mephitis mephitis (Schreber) 1776 — striped skunk
*Lutra canadensis (Schreber) 1776 — river otter
*Felis (Puma) cf. inexpectata (Cope) 1896 — puma
 Felis (Herpailurus or Noctifelis) sp. — margay or jaguarundi-like cat
*Felis (Lynx) rufus (Schreber) 1777 — bobcat
 Panthera (Jaguarius) augusta (Leidy) 1872 — extinct jaguar
 Smilodon cf. floridanus (Leidy) 1889 — saber-toothed cat
*Monachus tropicalis (Gray) 1850 — West Indian monk seal
*Mammut americanum (Kerr) 1792 — American mastodon
*Mammuthus columbi (Falconer) 1857 — Columbian mammoth
?*Mammuthus imperator? (Leidy) 1859 — imperial mammoth
*Equus sp. — horse
*Tapirus veroensis Sellards 1918 — Vero tapir
 Platygonus, near P. compressus Le Conte 1848 — extinct peccary[13]
 Platygonus cf. cumberlandensis Gidley 1920 — extinct peccary
 Mylohyus gidleyi Simpson 1929 — extinct peccary
 Mylohyus cf. exhortivus Gidley 1920 — extinct peccary
 Tayassu (including Pecari) sp. — peccary

A record of *?Pecari* sp. listed by Simpson (1929a, p. 268) may indicate the presence of a second species of *Tayassu*, related to the living collared peccary.

*Tanupolama mirifica Simpson 1929 — extinct camelid
*Odocoileus virginianus (Boddaert) 1784 — white-tailed deer
 Cervus? sp. — large wapiti-like deer
*Bison sp. — bison

13 Peccary remains in the Singleton Collection are identifiable to genus only.

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